

PATENT COOPERATION TREATY
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

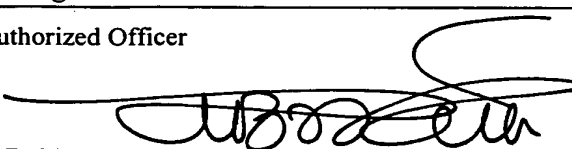
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Applicant's or agent's file reference MMM002	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).	
International application No. PCT/AU 00/01063	International filing date (<i>day/month/year</i>) 08 September 2000	Priority Date (<i>day/month/year</i>) 09 September 1999
International Patent Classification (IPC) or national classification and IPC Int. Cl.⁷ H05B 3/84, 3/86 A47G 1/00, A47F 11/04, B60R 1/00, G02B 5/08		
Applicant 1. PILLINGER, Barry Ernest		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.																
2.	This REPORT consists of a total of 4 sheets, including this cover sheet. <input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of 11 sheet(s).																
3.	This report contains indications relating to the following items: <table border="0"> <tr> <td>I</td> <td><input checked="" type="checkbox"/> Basis of the report</td> </tr> <tr> <td>II</td> <td><input type="checkbox"/> Priority</td> </tr> <tr> <td>III</td> <td><input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td>IV</td> <td><input type="checkbox"/> Lack of unity of invention</td> </tr> <tr> <td>V</td> <td><input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td>VI</td> <td><input checked="" type="checkbox"/> Certain documents cited</td> </tr> <tr> <td>VII</td> <td><input type="checkbox"/> Certain defects in the international application</td> </tr> <tr> <td>VIII</td> <td><input type="checkbox"/> Certain observations on the international application</td> </tr> </table>	I	<input checked="" type="checkbox"/> Basis of the report	II	<input type="checkbox"/> Priority	III	<input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	IV	<input type="checkbox"/> Lack of unity of invention	V	<input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	VI	<input checked="" type="checkbox"/> Certain documents cited	VII	<input type="checkbox"/> Certain defects in the international application	VIII	<input type="checkbox"/> Certain observations on the international application
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VII	<input type="checkbox"/> Certain defects in the international application																
VIII	<input type="checkbox"/> Certain observations on the international application																

Date of submission of the demand 06 April 2001	Date of completion of the report 08 August 2001
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I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed.
- ☒ the description, pages **1**, as originally filed,
pages , filed with the demand,
pages **2-9**, received on **23 July 2001** with the letter of **23 July 2001**.
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages **10-12**, received on **23 July 2001** with the letter of **23 July 2001**.
- ☒ the drawings, pages **1/2-2/2**, as originally filed,
pages , filed with the demand,
pages , received on with the letter of .
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of .

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-14	YES
	Claims None	NO
Inventive step (IS)	Claims 1-14	YES
	Claims None	NO
Industrial applicability (IA)	Claims 1-14	YES
	Claims None	NO

2. Citations and explanations (Rule 70.7)

Documents:

D1: EP 670665A (SAINT- GOBAIN VITRAGE), 6 September 1995

D2: US 3887788A (SEIBEL et al), 3 June 1975

D3: EP 893838A (SAINT- GOBAIN VITRAGE), 27 January 1999

2.1 Novelty (N) and Inventive Step (I)

D1 and D3 are the most relevant documents. However neither of them individually or in combination can be considered to anticipate the invention as claimed in the independent claims 1 and 12. D3 does not disclose a mirrored sheet means; although D1 discloses the usage to avoid condensation on bathroom mirrors it does not disclose a bonding medium to bond together the first and second sheet means. These claims 1 and 12 are considered to be novel and to involve an inventive step. Claim 2-11 and 13-14 are appended claims which add further features to claims 1 and 12 and hence are also considered novel and inventive.

2.2 All the claims 1-14 satisfy the criteria of Industrial Applicability.

VI. Certain documents cited**1. Certain published documents (Rule 70.10)**Application No.
Patent No.Publication date
(day/month/year)Filing date
(day/month/year)Priority date (valid claim)
(day/month/year)

JP11-314943A

16 November 1999

05 February 1999

ABSTRACT(TATSUNO KUCHI
KOGYO GLASSKK)Derwent Abstract Accession
No. 2000-278848/24,
Class Q17, X25

14 March 2000

17 June 1998

JP2000 077173 (ASAHI
GLASS CO. LTD)**2. Non-written disclosures (Rule 70.9)**

Kind of non-written disclosure

Date of non-written disclosure
(day/month/year)Date of written disclosure referring to non-
written disclosure
(day/month/year)

US-A-5,347,106 of 1992 discloses a mirror assembly which uses a reflective coating as a heating element for preventing fog formation on a mirror exposed to a humid environment. US-A-5,731,569 shows a device for attachment to a mirror to prevent the formation of condensation thereon, the device including a
5 pad element containing a heat-retaining gel and a heating element located in the gel. Numerous other prior patent specifications from, particularly, the 1970s, indicated that no one inventor has found the optimal non-fogging mirror arrangement.

It is an object of this invention to provide an improved condensation prevention
10 and/or removal arrangement for a mirror.

The invention provides an anti-fogging mirror assembly, characterised in that said assembly includes first sheet means, second sheet means, and a bonding medium adapted to bond together said first sheet means and said second sheet means, in that said bonding medium is associated with heating means, said
15 heating means being adapted to heat at least part of said assembly, and in that one of said first sheet means and said second sheet means is a mirrored sheet means.

The invention also provides a method of producing an anti-fogging mirror assembly, characterised by the steps of:

20 assembling first sheet means and second sheet means, said first sheet means being mirrored sheet means, with a gap between said first sheet means and said second sheet means;

locating heating means in said gap; and

25 filling at least part of said gap with a bonding medium, such that said first sheet means and said second sheet means are bonded together, and such that said heating means is embedded in said bonding medium.

Embodiments of the invention, which may be preferred, will be described in detail hereinafter, with reference to the accompanying drawings, in which:—

Fig. 1 is a side elevation of part of a laminated mirror glass assembly, incorporating heating means, in accordance with an embodiment of the present
5 Invention;

Fig. 2 is an exploded view of the mirror glass assembly of Fig. 1;

Fig. 3 is a plan view of one form of electrical connection which may be used with the mirror glass assembly of Figs. 1 and 2; and

Fig. 4 is a plan view of one form of heating element arrangement for use in the
10 assembly of Figs. 1 to 3.

The present invention has for its aim an anti-fogging mirror assembly of components and materials, which will inhibit the formation of condensation on the mirror surface, while also incorporating a safety feature.

Turning firstly to Fig. 1, the illustrated embodiment of a condensation-free mirror
15 arrangement 10 includes a sheet of mirror glass 12 having a reflective coating 14 at the rear surface thereof. A sheet of translucent glass 16 is located to the rear of reflective coating 14. Sheets 12 and 16 are bonded together by a bonding medium 18, in which a heating element 20 is located.

The mirror assembly 10 in its simplest form, that shown in Fig. 1, may be seen
20 as a lamination of two sheets of glass (12, 16) by a bonding agent (18), thus forming a laminated sheet (10) of material, which includes a heating element 20 embedded in the bonding medium.

Fig. 2 shows in exploded form a more detailed view of the condensation-free mirror arrangement 10 of Fig. 1. In Fig. 2, the three sheets, the sheet of mirror
25 glass 12, the translucent sheet of glass 16, and the bonding medium 18 (in a

soldified form) are shown in a preferred situation in which at least the external dimensions of the sheets 12, 16 are substantially identical. More preferably, the mirror glass sheet 12 may vary in thickness from about 2mm to about 6mm, and the translucent glass sheet 16 may preferably be about 3mm in thickness. Glass
5 sheet 16 preferably has a generally circular aperture 34 therein, near the base thereof, for the supply of electrical power to the heating element 20, as will be described hereinafter.

Bonding medium 18 bonds sheets 12, 16 together. It is to be understood that sheets 12, 16 may be formed from any suitable material, but that glass is
10 preferred. It may well be that at least sheet 16 may be made from an alternative material. Preferably, the bonding medium 18 is a semi-translucent rapid cure resin material. The thickness of the bonding medium 18 in the assembly 10 may accordingly be within the limits of the manufacturer's specifications, and preferably would be within a nominal maximum thickness of about 1.8mm. One
15 additional advantage of the laminate of assembly 10 is that the bonding medium 18 protects reflective surface 14 from damage.

The heating means for the mirror assembly 10 is preferably in the form of an electrical resistance heating element 20, depicted by broken lines in Fig. 2. More preferably, the heating element 20 is of a type which incorporates a polyester
20 film substrate printed with a conductive vinyl baked ink with one or more bus bars (preferably of copper, which may be tinned, but alternatively of solder or silvered, or of conductive foil) located near the outer edges of the opposite sides of the conductive ink, which may be covered by an insulation layer (not shown), similar to the substrate, with a selvedge (not shown) protruding beyond the bus
25 bars. A particular example of such a heating element 20 is shown and will be subsequently described in relation to Fig. 4.

The heating element 20 will preferably be prepared prior to the lamination process by suitably affixing (preferably by soldering) electrical leads 22 and 24 (Fig. 3) to a bus bar 26 (Figs. 3 and 4). The thickness of the heating element 20
30 will be minimal, particularly in relation to the thickness of the sheets 12, 16 and

the bonding medium 18; the thickest section is anticipated to be near the bus bars 26, 68, where it may be in the vicinity of about 300 microns.

Alternative heating elements may be used, in which other conductive media such as foil conductive material may have terminal connections similarly closely positioned. The dimensions of the heating element 20 may be varied, and may be in the form of a singular sheet in the form of multiple sheets suitably connected for satisfactory connection to electrical power, and satisfaction of assembly. Preferably, the external dimensions of the heating element 20 will be less than those of sheets 12, 16, so that a border is created around the outer periphery of the element 20, to enable the element 20 to be visible through the bonding medium 18 and the translucent sheet 16. The border may have a width of about 100mm to permit an uninterrupted view of the element 20.

One form of heating element of the foil type does not require a bus bar, and has a "maze" pattern, and as a consequence the terminal points for the connection of the element to a source of electrical energy may be located in any position, although a preference would be for a connection along any one outer edge of the pattern. The use of such an alternative heating element would enable the position of the electrical connection to be altered from the position shown in the embodiment of Figs. 3 and 4.

The assembly 10, which has been stated is in the form of a laminate, may be produced in any suitable manner. One method of producing the laminate is to locate sheets 12, 16 a predetermined distance from each other, with sheet 16 to the rear of mirrored sheet 12. Heating pad 20 is located in the gap between sheets 12 and 16, and is held in registration in that position by the location of part of a junction facility 30, to be described hereinafter, in aperture 34 in sheet 16.

Three sides of the preliminary assembly of sheets 12 and 16 and heating pad 20 may be closed, for example by placing adhesive tape along three sides of the gap between the sheets 12 and 16 to close off the gap along those sides, with

the open side at the top of the preliminary assembly. A preferred tape may be narrow-width 3M (Trade Mark) double-sided adhesive tape. The bonding material 18, in the form of a liquid rapid-cure resin material, may then be poured in through the top, until it reaches a predetermined level. The top gap may also
5 then be sealed with adhesive tape or the like, and the preliminary assembly is then laid flat until the resin cures, at which time the assembly 10 is created.

In Fig. 2 an exposed section 28 of heating element 20 is shown, which section includes sections 60, 62 of bus bar 26 (Fig. 4). A junction facility 30, which may be a preferred form of connecting heating element 20 to a source of electrical
10 power, is also shown. A flanged base portion 32 of junction facility 30 is intended to be attached to the exposed portion 28 of heating element 20. The base portion includes a planar part and a cylindrical part, the latter being adapted to protrude, in the final assembly 10, through a circular aperture 34 in translucent sheet 16. The junction facility 30 may be formed from any suitable material from
15 which a similar unit, such as an electrical terminal block, may be formed. One preferred material may be polyvinyl chloride (PVC).

Base portion 32 is preferably attached to exposed portion 28 of heating element 20 by means of pressure sensitive adhesive means 38 or by any other suitable method. The electrical connection will be described with reference to the
20 description relating to Figs. 3 and 4. In the mirror assembly 10, a cover 36 will be placed on that part of base portion 32 which protrudes through the aperture 34 in sheet 16.

Fig. 3 shows one form of junction facility 30 for electrically connecting heating element 20 to a source of electrical power. A power cord 40 supplies electrical
25 power, and may be physically clamped to the junction facility 30 by a "saddle" or other cord anchor 70. The wires 42, 44 of power cord 40 are connected to a terminal connecting device 46. Lead 22, which is connected to wire 44 through block 46, is connected to terminal 48 on one section of bus bar 26. Lead 50, which is electrically connected to wire 42 through block 46, is connected to
30 terminal 52 of thermostat 54. Lead 24 connects terminal 56 of thermostat 54 to

terminal 58 on another section of bus bar 26.

The exemplary heating element 20 of Fig. 4 is suitable for use with the assembly of Figs. 1 and 2, and with the junction facility 30 of Fig. 3. It may have the specifications of the "Flexel Model Mk 4" produced by Flexel International Limited of the United Kingdom. The element 20 includes the aforementioned printed vinyl ink portion 66, which has a preferred pattern of vertical lines, and which is connected to upper (68) and lower (26) bus bars, which as has been stated previously, are preferably formed from copper. Bus bar 26 has a portion cut out at 64, preferably around the centre thereof. That facilitates the connection of leads, in a manner to be described hereinafter, to the bus bar 26 at respective locations thereon. This results in the flow of electricity through the bus bar 26 to one side of the cutout 64, there being a void section between the printed lines of the ink 66, the void section being directly above the cutout 64, to the opposite bus bar 68, and then through the other portion of ink 66 to the other part of bus bar 26. An alternative heating element may include three bus bars, instead of two. Such an arrangement would enable the heating element to be operated at the Australian/UK voltage of 220V/240V AC, or the United States (and other countries) voltage of 110V AC.

Terminals 48, 58 are on separated portions 60, 62 of bus bar 26 of heating element 20, the separated portions 60, 62 having been electrically separated from each other, by cutting or otherwise separating bus bar 26 at 64 (Fig. 4). Separated portions 60, 62 are revealed by exposed portion 28 of heating element 20. The exposed portion 28 of heating element 20 is accessible through the open end of the flanged junction facility 30. This method of connecting power to a heating element is known as a "2-in-series" connection.

It is to be understood that the particular means by which the wiring connection for providing power to one or more heating elements may be varied according to the type of element or elements used. In addition, a second access point to heating element 20 may be provided.

Thermostat 54 is a non-essential feature of junction facility 30. A basic assembly 10 may not include a thermostat 54, in which case lead 42 may directly connect to terminal 58, and lead 44 may connect directly to terminal 48. However, a thermostat such as thermostat 54 is preferred. The thermostat 54 is
5 adapted to be attached to heating element 20 such that the temperature of the element 20 activates the thermostat 54. When the temperature of the element 20, at the point where it is connected to thermostat 54, reaches a predetermined level, the electric circuit powering the element 20 will be opened, switching off the electrical power until the temperature drops below the predetermined level.
10 At that time, the bi-metal contacts (not shown) of thermostat 54 will close to again allow electricity to flow to the heating element 20.

The thermostat 54 may be of the self-enclosed heat sensing type or may have an external sensor which may extend to another section of heating element 20 or of the assembly 10, such as the mirrored sheet 12. In such an arrangement, the
15 thermostat 54 does not need to be affixed to the surface of the heating element 20.

A further embodiment of the invention, which may be preferred, includes the provision of a fuse, either of a conventional fuse-wire type or of a circuit-breaker type, which when overloaded will cut the supply of electricity to the heating
20 element 20. Another embodiment of the invention envisages allowing the temperature of the heating element 20 to change (in particular rise) at the same rate as the ambient temperature, by the use of a self-regulating element which has a high resistance to prevent overheating, and which may accordingly result in a thermostat not necessarily being fitted to the assembly 10.

25 Removable cover 36 of junction facility 30 is preferably fashioned to permit the two-core power cord 40 to enter the junction facility 30. Furthermore, if a fuse is to be used, it may be integrated into the circuit, and housed within the junction facility 30.

The final assembly 10, in the form of a laminate, is designed to be used as an

anti-fogging and condensation-free mirror. When the heating pad 20 is energised, it will heat the assembly 10, in particular the mirrored sheet 12. When the mirrored sheet 12 is so heated, any moisture on the mirror, which may be fogging the mirror, will be evaporated, and the mirror will then become clear.

- 5 Alternatively or additionally, when the mirrored sheet 12 is heated, moisture such as steam, which is present at certain times in the air of a bathroom, will not be able to condense on the mirror, and fog the mirror. The mirror will accordingly stay clear.

- The fact that the assembly 10 is in the form of a laminate means that it is also a
10 safety mirror, one which will not shatter into dangerous shards of glass if broken. Preferably, the outer edges of the mirror sheet may be clean cut, smooth-edged or bevelled, and the assembly 10 may be wall-mounted by the use of a satisfactory technique, or may be enclosed in a frame or the like in a suitable manner. The latter arrangement may involve the addition of a layer of insulation,
15 most likely at the rear of the assembly 10, and/or the addition of a satisfactory backing board. However, access to the junction facility 30 must be able to be maintained.

It can be seen that this invention provides an improved anti-fogging mirror assembly in the form of a safety laminate.

- 20 The entire contents of the specification and drawings of Australian provisional patent application no. PQ2720, filed on 9 September 1999, are hereby incorporated into the disclosure of this specification.

The claims form part of the disclosure of this specification.

CLAIMS

1. An anti-fogging mirror assembly, characterised in that said assembly includes first sheet means, second sheet means, and a bonding medium adapted to bond together said first sheet means and said second sheet means, in that said bonding medium is associated with heating means, said heating means being adapted to heat at least part of said assembly, and in that one of said first sheet means and said second sheet means is a mirrored sheet means.
5
2. An anti-fogging mirror assembly according to claim 1, characterised in that said heating means is adapted to heat said mirrored sheet means so that any moisture on said mirrored sheet means is evaporated, and in that moisture is prevented from forming on said mirrored sheet means.
10
3. An anti-fogging mirror assembly according to any preceding claim, characterised in that said heating means is embedded within said bonding medium.
15
4. An anti-fogging mirror assembly according to claim 3, characterised in that said heating means is an electric resistance heating element.
5. An anti-fogging mirror assembly according to claim 4, characterised in that said electric resistance heating element incorporates a film substrate with a conductive ink printed thereon.
20
6. An anti-fogging mirror assembly according to claim 4, characterised in that said electric resistance heating element is of a foil type with a "maze" pattern.
7. An anti-fogging mirror assembly according to any preceding claim, characterised in that said assembly is in the form of a laminated sheet assembly.
25

8. An anti-fogging mirror assembly according to any one of claims 4 to 7, characterised in that electrical power is supplied to said heating element through a junction facility.
- 5 9. An anti-fogging mirror assembly according to any one of claims 4 to 8, characterised in that a thermostat is located in the electrical circuit supplying electricity to said heating element, said thermostat monitoring the temperature of said heating element, directly or indirectly.
- 10 10. An anti-fogging mirror assembly according to any one of claims 4 to 9, characterised in that a fuse is located in the circuit supplying electrical power to said heating element.
11. An anti-fogging mirror assembly according to any one of claims 7 to 10, characterised in that said assembly is located in a frame or support.
12. A method of producing an anti-fogging mirror assembly, characterised by the steps of:
 - 15 assembling first sheet means and second sheet means, said first sheet means being mirrored sheet means, with a gap between said first sheet means and said second sheet means;
 - locating heating means in said gap; and
 - 20 filling at least part of said gap with a bonding medium, such that said first sheet means and said second sheet means are bonded together, and such that said heating means is embedded in said bonding medium.
13. A method according to claim 12, characterised in that said heating means is an electrical resistance heating element.
14. An anti-fogging mirror assembly produced by the method according to

claim 12 or claim 13.

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(71) Applicant and

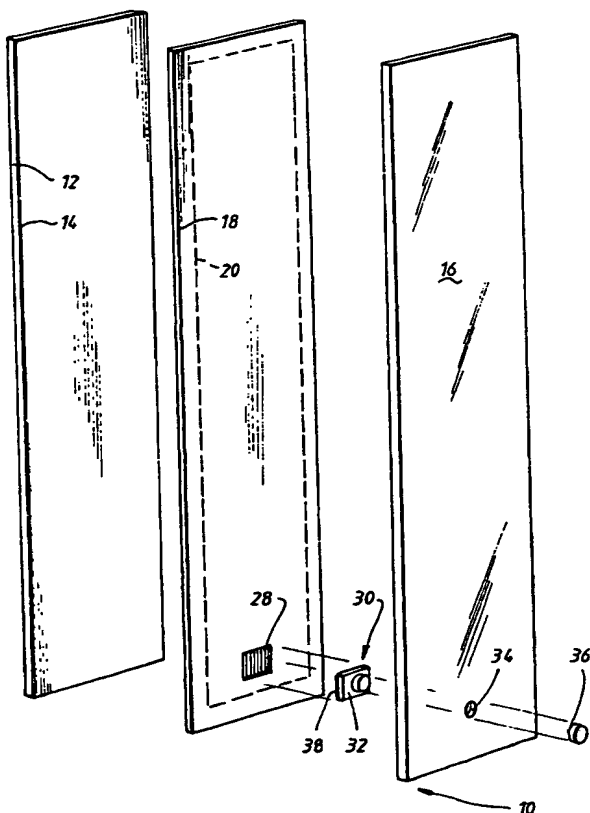
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19 Expo Court, Ashmore, QLD 4214 (AU).

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[Continued on next page]

(54) Title: LAMINATED ANTI-FOGGING MIRROR ASSEMBLY



(57) Abstract: An anti-fogging mirror assembly (10) comprises a mirrored sheet (12), a second sheet (16), and a bonding medium (18) adapted to bond together the mirrored sheet (12) and the second sheet (16). The bonding medium (18) has embedded in it a heating pad (20) in the form of an electrical resistance heating element, which, when it is supplied with electrical energy, heats the mirrored sheet (12) such that any moisture on the mirrored sheet (12) is evaporated, and condensation of moisture on the mirrored sheet (12) is prevented. The heating element (20) may be in the form of a polyester substrate printed with a conductive ink, and electrical energy to the heating element (20) may be supplied through upper (68) and lower (26) bus bars. A thermostat (54) may be provided such that when the heating element (20) reaches a predetermined temperature electrical energy is no longer supplied to the heating element (20).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

LAMINATED ANTI-FOGGING MIRROR ASSEMBLY

This invention relates to mirrors, and in particular relates to the removal of condensation from mirrors.

- A bathroom usually features at least one mirror, which is used for shaving, combing the hair, the application of cosmetics, and so on. However, the nature of bathrooms is such that steam is generated by showers, baths and/or hot water in a basin, such basins being often situated directly beneath a mirror. The same situation applies to areas adjoining spas, saunas, steam rooms and the like, in commercial and domestic situations. The result is that even when an extractor is used to vent air and steam from a bathroom or similar area, condensation tends to form on mirrors, resulting in the restriction of the reflected image and an unsightly appearance. Attempts to clear the mirror by the use of an accessible item such as a towel, are generally unsatisfactory and are often a cause of further annoyance.
- As early as 1949, a "non-blurabble mirror" was being suggested, to prevent or remove condensation. US-A-2,564,836 discloses a mirror in which an electrical heating unit is located at the rear surface of the mirror, the heating unit incorporating a layer of an electrically conductive rubber composition. When actuated, the heating element heats the rear surface of the mirror, then the front surface, as a result of which vapour condensation or moisture on the front surface is prevented or removed.

- Subsequent condensation-free mirror arrangements have had generally similar arrangements, in which resistance heating has been used to heat the mirror to remove condensation therefrom. US-A-3,887,788 of 1972, discloses a condensation-free mirror in which a printed circuit board heating element is mounted on the rear surface of a mirror. US-A-4,060,712 of 1976 shows a heated mirror arrangement in which a heating element is woven horizontally on an insulation plate, and has a centrally enlarged portion to enable the temperature to be the same at all portions of the front face of the mirror.

US-A-5,347,106 of 1992 discloses a mirror assembly which uses a reflective coating as a heating element for preventing fog formation on a mirror exposed to a humid environment. US-A-5,731,569 shows a device for attachment to a mirror to prevent the formation of condensation thereon, the device including a
5 pad element containing a heat-retaining gel and a heating element located in the gel. Numerous other prior patent specifications from, particularly, the 1970s, indicated that no one inventor has found the optimal non-fogging mirror arrangement.

It is an object of this invention to provide an improved condensation prevention
10 and/or removal arrangement for a mirror.

The invention provides an anti-fogging mirror assembly, characterised in that said assembly includes first sheet means, second sheet means, and a bonding medium adapted to bond together said first sheet means and said second sheet means, said bonding medium being associated with heating means, said heating
15 means being adapted to heat at least part of said assembly.

The invention also provides a method of producing an anti-fogging mirror assembly, characterised by the steps of:

assembling first sheet means and second sheet means with a gap between said first sheet means and said second sheet means;

20 locating heating means in said gap; and

filling at least part of said gap with a bonding medium, such that said first sheet means and said second sheet means are bonded together, and such that said heating means is embedded in said bonding medium.

Embodiments of the invention, which may be preferred, will be described in detail
25 hereinafter, with reference to the accompanying drawings, in which:—

Fig. 1 is a side elevation of part of a laminated mirror glass assembly, incorporating heating means, in accordance with an embodiment of the present invention;

Fig. 2 is an exploded view of the mirror glass assembly of Fig. 1;

- 5 Fig. 3 is a plan view of one form of electrical connection which may be used with the mirror glass assembly of Figs. 1 and 2; and

Fig. 4 is a plan view of one form of heating element arrangement for use in the assembly of Figs. 1 to 3.

The present invention has for its aim an anti-fogging mirror assembly of
10 components and materials, which will inhibit the formation of condensation on the mirror surface, while also incorporating a safety feature.

Turning firstly to Fig. 1, the illustrated embodiment of a condensation-free mirror arrangement 10 includes a sheet of mirror glass 12 having a reflective coating 14 at the rear surface thereof. A sheet of translucent glass 16 is located to the rear
15 of reflective coating 14. Sheets 12 and 16 are bonded together by a bonding medium 18, in which a heating element 20 is located.

The mirror assembly 10 in its simplest form, that shown in Fig. 1, may be seen as a lamination of two sheets of glass (12, 16) by a bonding agent (18), thus forming a laminated sheet (10) of material, which includes a heating element 20
20 embedded in the bonding medium.

Fig. 2 shows in exploded form a more detailed view of the condensation-free mirror arrangement 10 of Fig. 1. In Fig. 2, the three sheets, the sheet of mirror glass 12, the translucent sheet of glass 16, and the bonding medium 18 (in a solidified form) are shown in a preferred situation in which at least the external
25 dimensions of the sheets 12, 16 are substantially identical. More preferably, the mirror glass sheet 12 may vary in thickness from about 2mm to about 6mm, and

the translucent glass sheet 16 may preferably be about 3mm in thickness. Glass sheet 16 preferably has a generally circular aperture 34 therein, near the base thereof, for the supply of electrical power to the heating element 20, as will be described hereinafter.

- 5 Bonding medium 18 bonds sheets 12, 16 together. It is to be understood that sheets 12, 16 may be formed from any suitable material, but that glass is preferred. It may well be that at least sheet 16 may be made from an alternative material. Preferably, the bonding medium 18 is a semi-translucent rapid cure resin material. The thickness of the bonding medium 18 in the assembly 10 may
10 accordingly be within the limits of the manufacturer's specifications, and preferably would be within a nominal maximum thickness of about 1.8mm. One additional advantage of the laminate of assembly 10 is that the bonding medium 18 protects reflective surface 14 from damage.

- The heating means for the mirror assembly 10 is preferably in the form of an
15 electrical resistance heating element 20, depicted by broken lines in Fig. 2. More preferably, the heating element 20 is of a type which incorporates a polyester film substrate printed with a conductive vinyl baked ink with one or more bus bars (preferably of copper, which may be tinned, but alternatively of solder or silvered, or of conductive foil) located near the outer edges of the opposite sides
20 of the conductive ink, which may be covered by an insulation layer (not shown), similar to the substrate, with a selvedge (not shown) protruding beyond the bus bars. A particular example of such a heating element 20 is shown and will be subsequently described in relation to Fig. 4.

- The heating element 20 will preferably be prepared prior to the lamination
25 process by suitably affixing (preferably by soldering) electrical leads 22 and 24 (Fig. 3) to a bus bar 26 (Figs. 3 and 4). The thickness of the heating element 20 will be minimal, particularly in relation to the thickness of the sheets 12, 16 and the bonding medium 18; the thickest section is anticipated to be near the bus bars 26, 68, where it may be in the vicinity of about 300 microns.

Alternative heating elements may be used, in which other conductive media such as foil conductive material may have terminal connections similarly closely positioned. The dimensions of the heating element 20 may be varied, and may be in the form of a singular sheet in the form of multiple sheets suitably
5 connected for satisfactory connection to electrical power, and satisfaction of assembly. Preferably, the external dimensions of the heating element 20 will be less than those of sheets 12, 16, so that a border is created around the outer periphery of the element 20, to enable the element 20 to be visible through the bonding medium 18 and the translucent sheet 16. The border may have a width
10 of about 100mm to permit an uninterrupted view of the element 20.

One form of heating element of the foil type does not require a bus bar, and has a "maze" pattern, and as a consequence the terminal points for the connection of the element to a source of electrical energy may be located in any position, although a preference would be for a connection along any one outer edge of the
15 pattern. The use of such an alternative heating element would enable the position of the electrical connection to be altered from the position shown in the embodiment of Figs. 3 and 4.

The assembly 10, which has been stated is in the form of a laminate, may be produced in any suitable manner. One method of producing the laminate is to
20 locate sheets 12, 16 a predetermined distance from each other, with sheet 16 to the rear of mirrored sheet 12. Heating pad 20 is located in the gap between sheets 12 and 16, and is held in registration in that position by the location of part of a junction facility 30, to be described hereinafter, in aperture 34 in sheet 16.

25 Three sides of the preliminary assembly of sheets 12 and 16 and heating pad 20 may be closed, for example by placing adhesive tape along three sides of the gap between the sheets 12 and 16 to close off the gap along those sides, with the open side at the top of the preliminary assembly. A preferred tape may be narrow-width 3M (Trade Mark) double-sided adhesive tape. The bonding
30 material 18, in the form of a liquid rapid-cure resin material, may then be poured

in through the top, until it reaches a predetermined level. The top gap may also then be sealed with adhesive tape or the like, and the preliminary assembly is then laid flat until the resin cures, at which time the assembly 10 is created.

In Fig. 2 an exposed section 28 of heating element 20 is shown, which section includes sections 60, 62 of bus bar 26 (Fig. 4). A junction facility 30, which may be a preferred form of connecting heating element 20 to a source of electrical power, is also shown. A flanged base portion 32 of junction facility 30 is intended to be attached to the exposed portion 28 of heating element 20. The base portion includes a planar part and a cylindrical part, the latter being adapted to protrude, in the final assembly 10, through a circular aperture 34 in translucent sheet 16. The junction facility 30 may be formed from any suitable material from which a similar unit, such as an electrical terminal block, may be formed. One preferred material may be polyvinyl chloride (PVC).

Base portion 32 is preferably attached to exposed portion 28 of heating element 20 by means of pressure sensitive adhesive means 38 or by any other suitable method. The electrical connection will be described with reference to the description relating to Figs. 3 and 4. In the mirror assembly 10, a cover 36 will be placed on that part of base portion 32 which protrudes through the aperture 34 in sheet 16.

Fig. 3 shows one form of junction facility 30 for electrically connecting heating element 20 to a source of electrical power. A power cord 40 supplies electrical power, and may be physically clamped to the junction facility 30 by a "saddle" or other cord anchor 70. The wires 42, 44 of power cord 40 are connected to a terminal connecting device 46. Lead 22, which is connected to wire 44 through block 46, is connected to terminal 48 on one section of bus bar 26. Lead 50, which is electrically connected to wire 42 through block 46, is connected to terminal 52 of thermostat 54. Lead 24 connects terminal 56 of thermostat 54 to terminal 58 on another section of bus bar 26.

The exemplary heating element 20 of Fig. 4 is suitable for use with the assembly

of Figs. 1 and 2, and with the junction facility 30 of Fig. 3. It may have the specifications of the "Flexel Model Mk 4" produced by Flexel International Limited of the United Kingdom. The element 20 includes the aforementioned printed vinyl ink portion 66, which has a preferred pattern of vertical lines, and which is
5 connected to upper (68) and lower (26) bus bars, which as has been stated previously, are preferably formed from copper. Bus bar 26 has a portion cut out at 64, preferably around the centre thereof. That facilitates the connection of leads, in a manner to be described hereinafter, to the bus bar 26 at respective locations thereon. This results in the flow of electricity through the bus bar 26 to
10 one side of the cutout 64, there being a void section between the printed lines of the ink 66, the void section being directly above the cutout 64, to the opposite bus bar 68, and then through the other portion of ink 66 to the other part of bus bar 26. An alternative heating element may include three bus bars, instead of two. Such an arrangement would enable the heating element to be operated at
15 the Australian/UK voltage of 220V/240V AC, or the United States (and other countries) voltage of 110V AC.

Terminals 48, 58 are on separated portions 60, 62 of bus bar 26 of heating element 20, the separated portions 60, 62 having been electrically separated from each other, by cutting or otherwise separating bus bar 26 at 64 (Fig. 4).
20 Separated portions 60, 62 are revealed by exposed portion 28 of heating element 20. The exposed portion 28 of heating element 20 is accessible through the open end of the flanged junction facility 30. This method of connecting power to a heating element is known as a "2-in-series" connection.

It is to be understood that the particular means by which the wiring connection
25 for providing power to one or more heating elements may be varied according to the type of element or elements used. In addition, a second access point to heating element 20 may be provided.

Thermostat 54 is a non-essential feature of junction facility 30. A basic assembly 10 may not include a thermostat 54, in which case lead 42 may
30 directly connect to terminal 58, and lead 44 may connect directly to terminal 48.

However, a thermostat such as thermostat 54 is preferred. The thermostat 54 is adapted to be attached to heating element 20 such that the temperature of the element 20 activates the thermostat 54. When the temperature of the element 20, at the point where it is connected to thermostat 54, reaches a predetermined level, the electric circuit powering the element 20 will be opened, switching off the electrical power until the temperature drops below the predetermined level. At that time, the bi-metal contacts (not shown) of thermostat 54 will close to again allow electricity to flow to the heating element 20.

The thermostat 54 may be of the self-enclosed heat sensing type or may have an external sensor which may extend to another section of heating element 20 or of the assembly 10, such as the mirrored sheet 12. In such an arrangement, the thermostat 54 does not need to be affixed to the surface of the heating element 20.

A further embodiment of the invention, which may be preferred, includes the provision of a fuse, either of a conventional fuse-wire type or of a circuit-breaker type, which when overloaded will cut the supply of electricity to the heating element 20. Another embodiment of the invention envisages allowing the temperature of the heating element 20 to change (in particular rise) at the same rate as the ambient temperature, by the use of a self-regulating element which has a high resistance to prevent overheating, and which may accordingly result in a thermostat not necessarily being fitted to the assembly 10.

Removable cover 36 of junction facility 30 is preferably fashioned to permit the two-core power cord 40 to enter the junction facility 30. Furthermore, if a fuse is to be used, it may be integrated into the circuit, and housed within the junction facility 30.

The final assembly 10, in the form of a laminate, is designed to be used as an anti-fogging and condensation-free mirror. When the heating pad 20 is energised, it will heat the assembly 10, in particular the mirrored sheet 12. When the mirrored sheet 12 is so heated, any moisture on the mirror, which may

be fogging the mirror, will be evaporated, and the mirror will then become clear. Alternatively or additionally, when the mirrored sheet 12 is heated, moisture such as steam, which is present at certain times in the air of a bathroom, will not be able to condense on the mirror, and fog the mirror. The mirror will accordingly
5 stay clear.

The fact that the assembly 10 is in the form of a laminate means that it is also a safety mirror, one which will not shatter into dangerous shards of glass if broken. Preferably, the outer edges of the mirror sheet may be clean cut, smooth-edged or bevelled, and the assembly 10 may be wall-mounted by the use of a
10 satisfactory technique, or may be enclosed in a frame or the like in a suitable manner. The latter arrangement may involve the addition of a layer of insulation, most likely at the rear of the assembly 10, and/or the addition of a satisfactory backing board. However, access to the junction facility 30 must be able to be maintained.

15 It can be seen that this invention provides an improved anti-fogging mirror assembly in the form of a safety laminate.

The entire contents of the specification and drawings of Australian provisional patent application no. PQ2720, filed on 9 September 1999, are hereby incorporated into the disclosure of this specification.

20 The claims form part of the disclosure of this specification.

CLAIMS

1. An anti-fogging mirror assembly, characterised in that said assembly includes first sheet means, second sheet means, and a bonding medium adapted to bond together said first sheet means and said second sheet means, said bonding medium being associated with heating means, said heating means being adapted to heat at least part of said assembly.
2. An anti-fogging mirror assembly according to claim 1, characterised in that one of said first sheet means and said second sheet means is a mirrored sheet means.
3. An anti-fogging mirror assembly according to claim 2, characterised in that said heating means is adapted to heat said mirrored sheet means so that any moisture on said mirrored sheet means is evaporated, and in that moisture is prevented from forming on said mirrored sheet means.
4. An anti-fogging mirror assembly according to any preceding claim, characterised in that said heating means is embedded within said bonding medium.
5. An anti-fogging mirror assembly according to claim 4, characterised in that said heating means is an electric resistance heating element.
6. An anti-fogging mirror assembly according to claim 5, characterised in that said electric resistance heating element incorporates a film substrate with a conductive ink printed thereon.
7. An anti-fogging mirror assembly according to claim 5, characterised in that said electric resistance heating element is of a foil type with a "maze" pattern.
8. An anti-fogging mirror assembly according to any preceding claim,

characterised in that said assembly is in the form of a laminated sheet assembly.

9. An anti-fogging mirror assembly according to any one of claims 5 to 8, characterised in that electrical power is supplied to said heating element through a junction facility.
10. An anti-fogging mirror assembly according to any one of claims 5 to 9, characterised in that a thermostat is located in the electrical circuit supplying electricity to said heating element, said thermostat monitoring the temperature of said heating element, directly or indirectly.
11. An anti-fogging mirror assembly according to any one of claims 5 to 10, characterised in that a fuse is located in the circuit supplying electrical power to said heating element.
12. An anti-fogging mirror assembly according to any one of claims 8 to 11, characterised in that said assembly is located in a frame or support.
13. A method of producing an anti-fogging mirror assembly, characterised by the steps of:
- assembling first sheet means and second sheet means with a gap between said first sheet means and said second sheet means;
- locating heating means in said gap; and
- filling at least part of said gap with a bonding medium, such that said first sheet means and said second sheet means are bonded together, and such that said heating means is embedded in said bonding medium.
14. A method according to claim 13, characterised in that said first sheet means is mirrored sheet means.

15. A method according to claim 13 or claim 14, characterised in that said heating means is an electrical resistance heating element.
16. An anti-fogging mirror assembly produced by the method according to any one of claims 13 to 16.

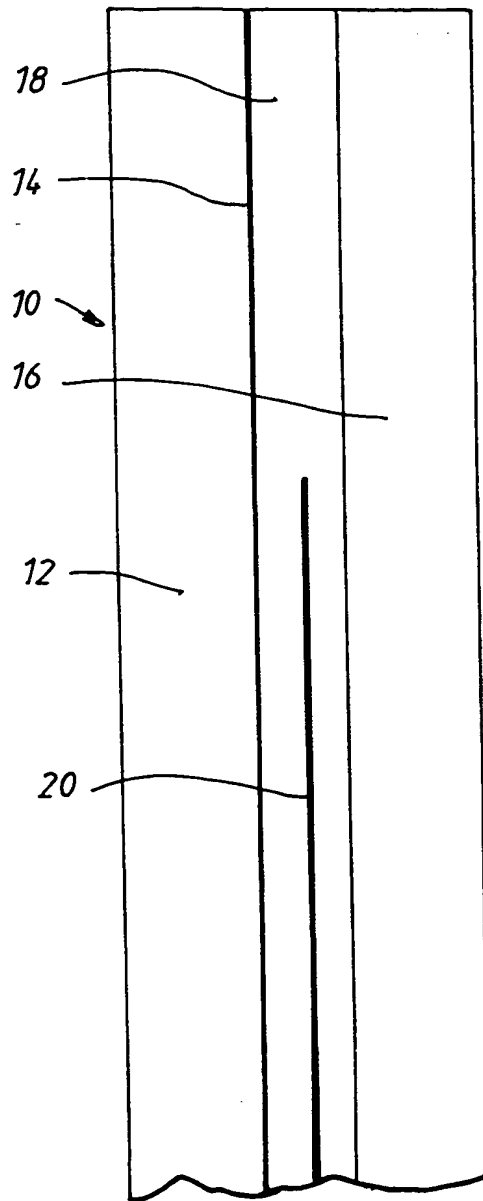


FIG. 1.

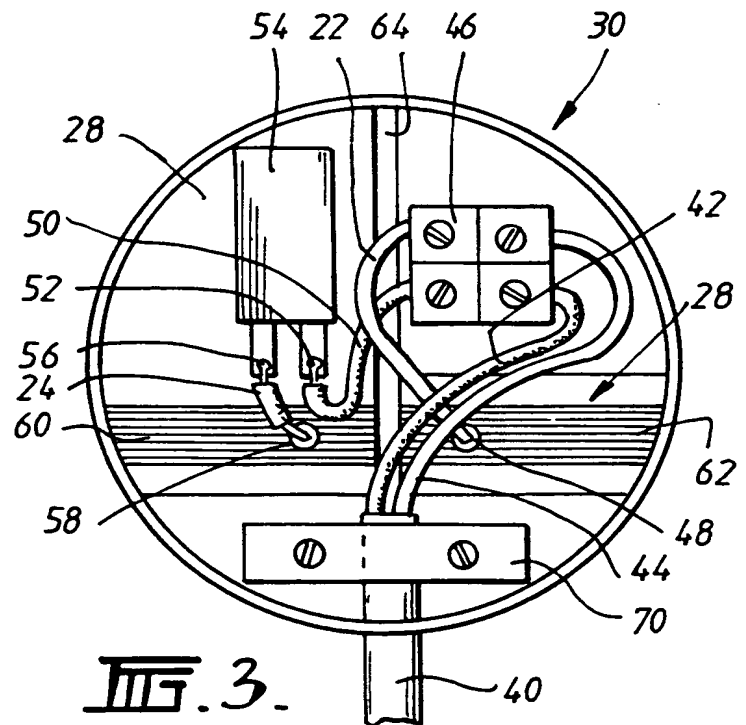


FIG. 3.

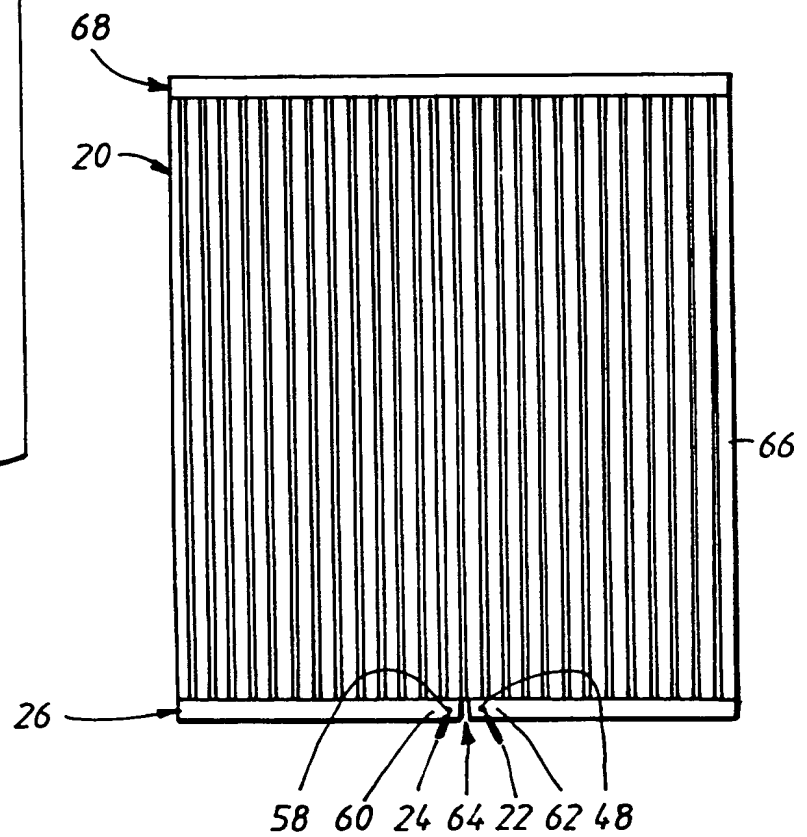


FIG. 4.

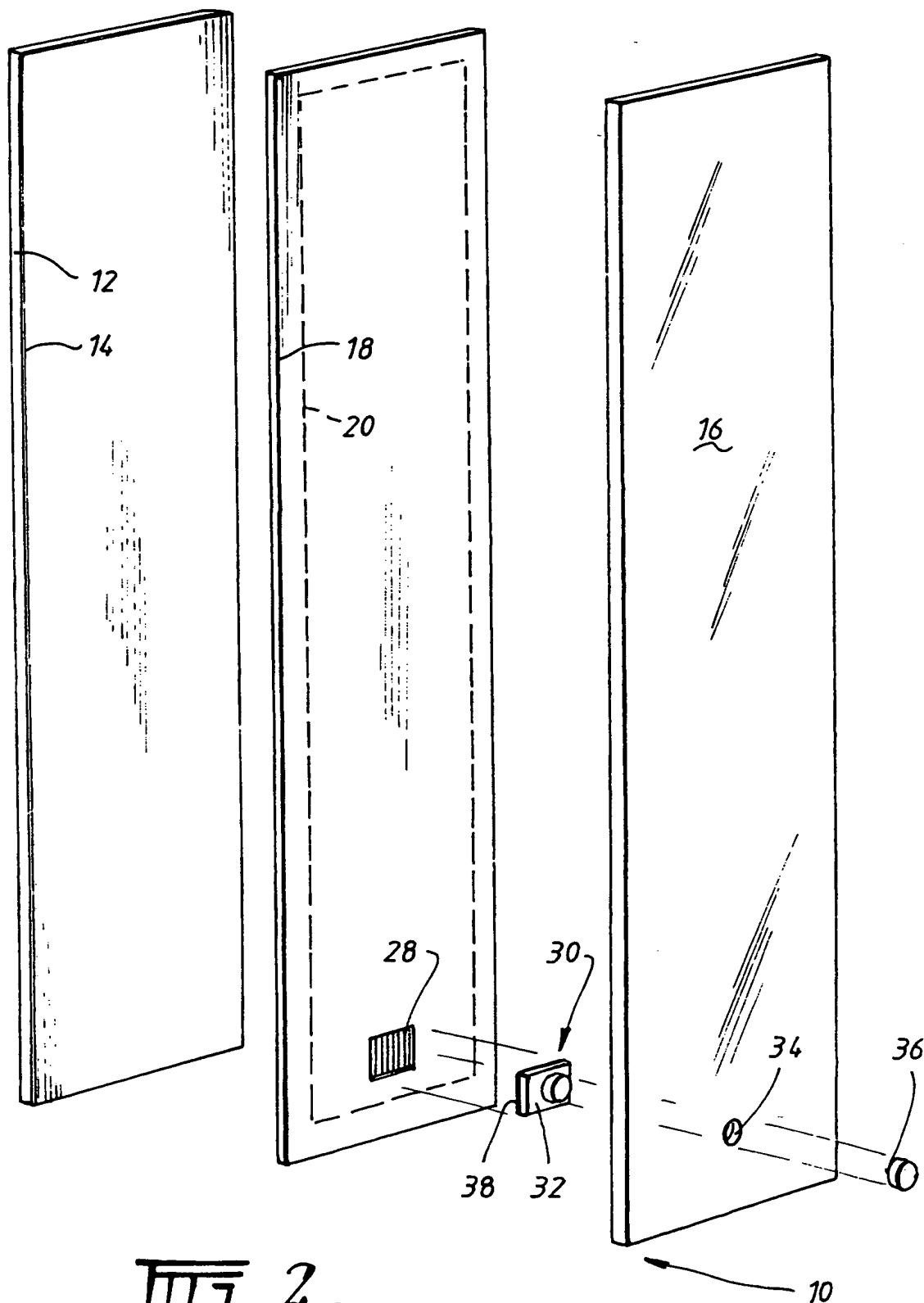


FIG. 2.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 00/01063

A. CLASSIFICATION OF SUBJECT MATTER		
Int Cl ⁷ : H05B 3/84, 3/86 A47G 1/00, A47F 11/04, B60R 1/00, G02B 5/08		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) IPC: H05B 3/84, 3/86, A47G 1/00, A47F 11/04, B60R 1/00, G02B 5/08		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched IPC: H05B 3/84, 3/86, A47G 1/00, A47F 11/04, B60R 1/00, G02B 5/08		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT in above IPC marks + keywords (FOG or ANTIFOG or MIST or DEMIST)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	Patents abstracts of Japan, JP 11-314943A (TATSUNOKUCHI KOGYO GLASS KK) 16 November 1999 Abstract	1-16
P,X	Derwent Abstract Accession No. 2000-278848/24, Class Q17 ; X25 JP 2000 077173A (ASAHI GLASS CO LTD) 14 March 2000 Abstract	1-16
X	EP 670665A (SAINT-GOBAIN VITRAGE) 6 September 1995 Figure 1	1-16
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
<p>* Special categories of cited documents:</p> <p>"A" Document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>		
Date of the actual completion of the international search 27 September 2000		Date of mailing of the international search report 1 NOV 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No.: (02) 6285 3929		Authorized officer G.B. NATH Telephone No.: (02) 6283 2126

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 00/01063

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CA 2100050A (METAGAL INDUSTRIES & COMERCIO LTD) 8 January 1995	1-16
X	US3887788A (SEIBEL et al), 3 June 1975	1-16
A	Patent abstracts of Japan, JP10-317330A (SEKISUI JUSHI KK) 2 December 1998	1-16
X	EP 893938A (SAINT-GOBAIN VITRAGE) 27 January 1999	1-16
A	Patents abstracts of Japan, JP 11-167001A (CANON KK) 22 June 1999 Abstract	1-16
A	US 4060712A (CHANG), 29 December 1977	1-16

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU 00/01063

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member	
EP	670665	FR	2717033		
CA	2100050	US	5440425		
EP	893938	FR	2766651	US	6034353
					END OF ANNEX